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**WO 02/25937 A2**

(54) Title: PRESENTING A VISUAL DISTRIBUTION OF TELEVISION PROGRAM RECOMMENDATION SCORES

(57) Abstract: A method and apparatus are disclosed for displaying the visual distribution of recommendation scores assigned to each television program by a television programming recommender. The visual distribution of recommendation scores can be presented to the user using a number of illustrative display formats. The invention defines a number of score ranges and indicates the number of television programs in each score range for a given time interval. Thus, the available programs are clustered based on their program recommendation scores. In addition, the visual presentation of the recommendation score distribution can be further improved by assigning a color to each score range. Thus, for a given time interval, the intensity (or saturation) of the color associated with a score range can be varied to indicate the corresponding number of programs having a recommendation score in the corresponding score range.

## Presenting a visual distribution of television program recommendation scores

### Field of the Invention

The present invention relates to television program recommenders, and more particularly, to a method and apparatus for presenting a visual distribution of television program recommendation scores.

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### Background of the Invention

As the number of channels available to television viewers has increased, along with the diversity of the programming content available on such channels, it has become increasingly challenging for television viewers to identify television programs of interest.

10 Historically, television viewers identified television programs of interest by analyzing printed television program guides. Typically, such printed television program guides contained grids listing the available television programs by time and date, channel and title. As the number of television programs has increased, it has become increasingly difficult to effectively identify desirable television programs using such printed guides.

15 More recently, television program guides have become available in an electronic format, often referred to as electronic program guides (EPGs). Like printed television program guides, EPGs contain grids listing the available television programs by time and date, channel and title. Some EPGs, however, allow television viewers to sort or search the available television programs in accordance with personalized preferences. In 20 addition, EPGs allow for on-screen presentation of the available television programs.

While EPGs allow viewers to identify desirable programs more efficiently than conventional printed guides, they suffer from a number of limitations, which if overcome, could further enhance the ability of viewers to identify desirable programs. For example, many viewers have a particular preference towards, or bias against, certain 25 categories of programming, such as action-based programs or sports programming. Thus, the viewer preferences can be applied to the EPG to obtain a set of recommended programs that may be of interest to a particular viewer.

Thus, a number of tools have been proposed or suggested for recommending television programming. The Tivo™ system, for example, commercially available from Tivo,

Inc., of Sunnyvale, California, allows viewers to rate shows using a "Thumbs Up and Thumbs Down" feature and thereby indicate programs that the viewer likes and dislikes, respectively. Thereafter, the TiVo receiver matches the recorded viewer preferences with received program data, such as an EPG, to make recommendations tailored to each viewer.

5 Thus, such tools for recommending television programming provide selections of programs that a viewer might like. Generally, conventional television program recommenders present ranked programs in a grid format.

Even with the aid of such program recommenders, however, it is still difficult for a viewer to identify programs of interest from among all the options. The non-

10 prepublished United States Patent Application Serial No. 09/519,550, filed March 6, 2000, entitled "Method and Apparatus for Displaying Television Program Recommendations," (Attorney's Docket No. PHUS000030), assigned to the assignee of the present invention and incorporated by reference herein, discloses a television programming recommender that displays available television programs with an indication of the recommendation score  
15 assigned to each program by a television programming recommender. The numerical recommendation scores associated with each program can be displayed with each program directly or can be mapped onto a color spectrum or another visual cue, such as a variable size-of-text or rate of blinking, that permits the user to quickly locate programs of interest.

Nonetheless, it remains difficult for the viewer to get a concise picture of the  
20 recommended programs. A need therefore exists for a method and apparatus for displaying television program recommendations in a summary manner indicating the visual distribution of program recommendation scores. A further need exists for a method and apparatus for displaying television program recommendations in a manner that clusters programs based on their program recommendation scores.

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### Summary of the Invention

The invention is defined by the independent claims. The dependent claims define advantageous embodiments.

Generally, a method and apparatus are disclosed for displaying available  
30 television programs using an indication of the visual distribution of recommendation scores assigned to each program by a television programming recommender. The visual distribution of recommendation scores can be presented to the user using a number of illustrative display formats.

Generally, the invention provides an indication of the number of television programs in each score range for a given time interval. Thus, the available programs are clustered based on their program recommendation scores. Among other benefits, the invention allows a user to quickly identify time periods when there are a higher number of 5 programs within a given program recommendation score range. In one illustrative implementation, the present invention defines four distinct score ranges (90-100, 80-90, 70-80 and 60-70) and indicates the number of programs in a given time interval having a recommendation score in each score range.

In addition, the visual presentation of the recommendation score distribution 10 can be further improved by assigning a color to each score range. Thus, for a given time interval, the intensity (or saturation) of the color associated with a score range can be varied to indicate the corresponding number of programs having a recommendation score in the corresponding score range.

A more complete understanding of the present invention, as well as further 15 features and advantages of the present invention, will be obtained by reference to the following detailed description and drawings.

#### Brief Description of the Drawings

FIG. 1 illustrates a television programming recommender in accordance with 20 the present invention;

FIG. 2 illustrates a sample table from the program database of FIG. 1; and

FIGS. 3A through 3B provide a number of illustrative presentation formats for presenting the recommendation score distributions in a convenient manner in accordance with the present invention.

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#### Detailed Description

FIG. 1 illustrates a television programming recommender 100 in accordance with the present invention. As shown in FIG. 1, the television programming recommender 100 evaluates each of the programs in an electronic programming guide (EPG) 110 to 30 identify programs of interest to a particular user. The set of recommended programs can be presented to the user using a set-top terminal/television 150, for example, using well known on-screen presentation techniques.

According to one feature of the present invention, the available programs are clustered based on their program recommendation scores. The present invention displays

television program recommendations in a summary manner indicating the visual distribution of program recommendation scores. Thus, the present invention allows a user to quickly identify time periods when there are a higher number of programs within a given program recommendation score range. In one application, the present invention allows a user to 5 determine, for example, when it is most worthwhile to watch television, as opposed to doing other potential activities.

Generally, the present invention provides an indication of the number of television programs in each score range for a given time interval. For example, in one illustrative implementation discussed herein, the present invention defines four distinct score 10 ranges, namely, a first score range associated with the most highly recommended programs having recommendation scores between 90 and 100, a second score range for programs having scores between 80 and 90; a third score range for programs having scores between 70 and 80, and a fourth score range for programs having scores between 60 and 70. In addition, to further improve the visual presentation of the recommendation score distribution, each 15 score range can be assigned a corresponding color as follows:

Score Range	Color
90-100	Red
80-90	Yellow
70-80	Green
60-70	Blue

Thus, a given color corresponds to a given score range. In addition, for a given time interval, the intensity (or saturation) of the color associated with a score range can 20 be varied in a linear manner to indicate the corresponding number of programs having a recommendation score in the corresponding score range. As discussed further below in conjunction with FIGS. 4A through 4C, a number of illustrative presentation formats are disclosed for presenting the recommendation score distributions in a convenient manner.

As shown in FIG. 1, the television programming recommender 100 contains a 25 program database 200, discussed further below in conjunction with FIG. 2, and a display recommendation process 300, discussed further below in conjunction with FIG. 3. Generally, the program database 200 records information for each program that is available in a given time interval. The display recommendation process 300 evaluates the program

recommendation scores for a set of programs and provides an indication of the number of television programs in each score range for a given time interval.

The television program recommender 100 may be embodied as any computing device, such as a personal computer or workstation, that contains a processor, such as a central processing unit (CPU), and memory, such as RAM and ROM. In addition, the television programming recommender 100 may be embodied as any available television program recommender, such as the Tivo™ system, commercially available from Tivo, Inc., of Sunnyvale, California, or the television program recommenders described in the non-prepublished United States Patent Application Serial No. 09/466,406, filed December 17, 1999, entitled "Method and Apparatus for Recommending Television Programming Using Decision Trees," (Attorney's Docket No. PHA 23.902) and the non-prepublished United States Patent Application Serial No. 09/498,271, filed Feb. 4, 2000, entitled "Bayesian TV Show Recommender," (Attorney Docket No. PHUS000018), or any combination thereof, as modified herein to carry out the features and functions of the present invention.

FIG. 2 is a sample table from the program database 200 of FIG. 1 that records information for each program that is available in a given time interval. As shown in FIG. 2, the program database 200 contains a plurality of records, such as records 205 through 220, each associated with a given program. For each program, the program database 200 indicates the date/time and channel associated with the program in fields 240 and 245, respectively. In addition, the title and genre for each program are identified in fields 250 and 255. Additional well-known attributes (not shown), such as actors, duration, and description of the program, can also be included in the program database 200.

In accordance with one feature of the present invention, the program database 200 also records an indication of the recommendation score assigned to each program by the television programming recommender 100 in field 270. In this manner, the numerical scores can be displayed to the user in a summary manner, with an indication of the number of television programs in each score range for a given time interval.

An exemplary display recommendation process 300 embodying principles of the present invention can be described as follows. The display recommendation process 300 initially obtains the electronic program guide (EPG) 110 for the time period of interest. Thereafter, the display recommendation process obtains the recommendation score from the recommender 100 for each available program in the time period of interest. The display recommendation process 300 then optionally maps the recommendation score to a desired visual cue, such as color or size-of-text. Next, programs having a recommendation score in

each score range are identified. Finally, the display recommendation process 300 increases the intensity (or saturation) of the corresponding color or gray-scale for each score range based upon the number of programs having a recommendation score within the score range.

As previously indicated, the present invention provides a number of 5 illustrative presentation formats for presenting the recommendation score distributions in a convenient manner. For example, each score range can be mapped to a given color and the intensity (or saturation) of the color can be varied in accordance with the number of programs in a given time interval having a recommendation score in that range.

FIG. 3A shows a variable gray-scale presentation of recommendation score 10 summaries for a 12-hour period covering noon to midnight. The display 400 is similar to an analog clock face. The face 410 is divided into four rings 411-414. The outermost ring 411 is associated with a first score range for the most highly recommended programs having recommendation scores between 90 and 100. The second ring 412 is associated with a second score range for programs having scores between 80 and 90. The third ring 413 is 15 associated with a third score range for programs having scores between 70 and 80. Finally, the fourth ring 414 is associated with a fourth score range for programs having scores between 60 and 70.

In the variable gray-scale embodiment shown in FIG. 3A, a variable gray-scale 20 intensity is used to indicate the number of programs falling within the corresponding score range. For example, maximum intensity can indicate ten or more programs falling with a given score range. In addition, the intensity can be reduced in a linear manner to indicate fewer than 10 programs in a given score range, down to a minimum value of zero intensity. For example, the time period 11 p.m. to midnight has a maximum intensity indicating that there are at least 10 highly recommended shows. On the other hand, the color white 25 (minimum intensity) in the period noon to 1 p.m. indicates that there are no highly recommended programs in that time period. For the time period 10 p.m. to 11 p.m., the high (but not maximum) intensity indicates a significant number of highly recommended programs, as well as a large number of programs with scores in the range 80-90.

FIG. 3B illustrates an alternate variable gray-scale presentation of 30 recommendation score summaries for a 12-hour period covering noon to midnight, in rectangular boxes. For each one-hour time period, the recommendation summary 420 includes four boxes 421-424. The top-most box 421 is associated with a first score range for the most highly recommended programs having recommendation scores between 90 and 100. The second box 422 is associated with a second score range for programs having scores

between 80 and 90. The third box 423 is associated with a third score range for programs having scores between 70 and 80. Finally, the fourth box 424 is associated with a fourth score range for programs having scores between 60 and 70. Again, a variable gray-scale intensity can be used in each box to indicate the number of programs falling within the  
5 corresponding score range.

A color implementation of the rectangular presentation shown in FIG. 3B, with a different color assigned to each score range, can be implemented as follows:

Score Range	Color
90-100	Red
80-90	Yellow
70-80	Green
60-70	Blue

Within each box, intensity (or saturation) is used to indicate the number of  
10 programs falling within the range. For example, maximum intensity (or saturation) can indicate ten or more programs falling with a given score range. In addition, the intensity (or saturation) can be reduced in a linear manner to indicate fewer than 10 programs in a given score range, down to a minimum value of zero intensity (white).

For example, the time period 11 p.m. to midnight is a bright red (full  
15 saturation), indicating that there are at least 10 highly recommended programs. The color white (zero saturation) in the top-box for the period noon to 1 p.m. indicates that there are no highly recommended programs in that period. For the time period 10 p.m. to 11 p.m., the high (but not maximum) red color saturation indicates a significant number of highly recommended programs, the bright yellow indicates a large number of programs with scores  
20 in the range 80-90.

The actual intensity or saturation values are computed using well-known algorithms in computer graphics. Although RGB (red, green, blue) values are required for the display hardware, it is generally easier to determine values according to the HSV (hue, saturation, value) model and then convert the result to a RGB representation. First, a hue  
25 value is selected corresponding to the color chosen for a given range of recommendation scores:

Hue Value	Color	Score Range
0	Red	90-100
0.160	Yellow	80-90
0.333	Green	70-80
0.6	Blue	60-70

Saturation is computed from  $n$ , the number of programs in the range. If  $n$  has a value greater than 10,  $n$  is replaced by 10. Then, the saturation value is the fraction  $n/10$ . Finally, the value is fixed at 1.0. This triple (hue, saturation, value) is then converted to (red, green, blue) according to a well-known algorithm. See, for example, "Fundamentals of Interactive Computer Graphics," by J.D. Foley and A. Van Dam, Addison-Wesley Publishing Company, ISBN 0-201-14468-9 (1982).

In a further variation, the user can optionally "click" on any score range for any time interval, to obtain a listing of each of the corresponding programs having a recommendation score in the given score range for the indicated time interval.

It is to be understood that the embodiments and variations shown and described herein are merely illustrative of the principles of this invention and that various modifications may be implemented by those skilled in the art without departing from the scope and spirit of the invention. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. The word "comprising" does not exclude the presence of elements or steps other than those listed in a claim. The word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The invention can be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed computer. In the device claim enumerating several means, several of these means can be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

## CLAIMS:

1. A method for displaying available television programs, comprising the steps of:
  - obtaining a list of available programs (110);
  - obtaining a recommendation score for each of said available programs (110);
  - 5 determining a number of programs within each of a plurality of recommendation score ranges; and
  - indicating a number of programs in each of said recommendation score ranges.
2. The method of claim 1, wherein each of said recommendation score ranges is assigned a corresponding color.  
10
3. The method of claim 1, wherein said number of programs in each of said recommendation score ranges is indicated using a variable gray-scale.
- 15 4. The method of claim 1, wherein said number of programs in each of said recommendation score ranges is indicated using a variable bar size.
5. The method of claim 1, wherein said number of programs in each of said recommendation score ranges is indicated using a variable size of text.  
20
6. The method of claim 1, wherein each of said recommendation score ranges is assigned a corresponding color and wherein said number of programs in each of said recommendation score ranges is indicated using a varying saturation of said corresponding color.
- 25 7. The method of claim 1, wherein said number of programs in each of said recommendation score ranges is indicated using a circular format divided into a plurality of rings, wherein each of said rings corresponds to a different one of said recommendation score ranges, and wherein each pie segment corresponds to a different time interval.

8. The method of claim 1, wherein said number of programs in each of said recommendation score ranges is indicated using a grid format having a plurality of rows and columns, and wherein each row in said grid corresponds to a different one of said recommendation score ranges, and each column in said grid corresponds to a different time interval.

9. A method for displaying available television programs, comprising the steps of:

obtaining a list of available programs (110);  
10 obtaining a recommendation score for each of said available programs (110);  
determining a number of programs within each of a plurality of recommendation score ranges;  
allocating a portion of a display to each of said plurality of recommendation score ranges for each of a plurality of time intervals; and  
15 indicating a number of programs in each of said recommendation score ranges for each of said time intervals in said corresponding display portion.

10. The method of claim 9, wherein said allocating step utilizes a circular format divided into a plurality of rings, wherein each of said rings corresponds to a different one of said recommendation score ranges, and wherein each pie segment corresponds to a different time interval.

11. The method of claim 9, wherein said allocating step utilizes a grid format having a plurality of rows and columns, and wherein each row in said grid corresponds to a different one of said recommendation score ranges, and each column in said grid corresponds to a different time interval.

12. A system (100) for displaying available television programs, comprising:  
a memory for storing computer readable code; and  
30 a processor operatively coupled to said memory, said processor configured to:  
obtain a list of available programs (110);  
obtain a recommendation score for each of said available programs (110);  
determine a number of programs within each of a plurality of recommendation score ranges; and

indicate a number of programs in each of said recommendation score ranges.

13. An article of manufacture for displaying available television programs, comprising:
  - 5 a computer readable medium having computer readable program code means embodied thereon, said computer readable program code means enabling a programmable device to carry out the method of claim 1.

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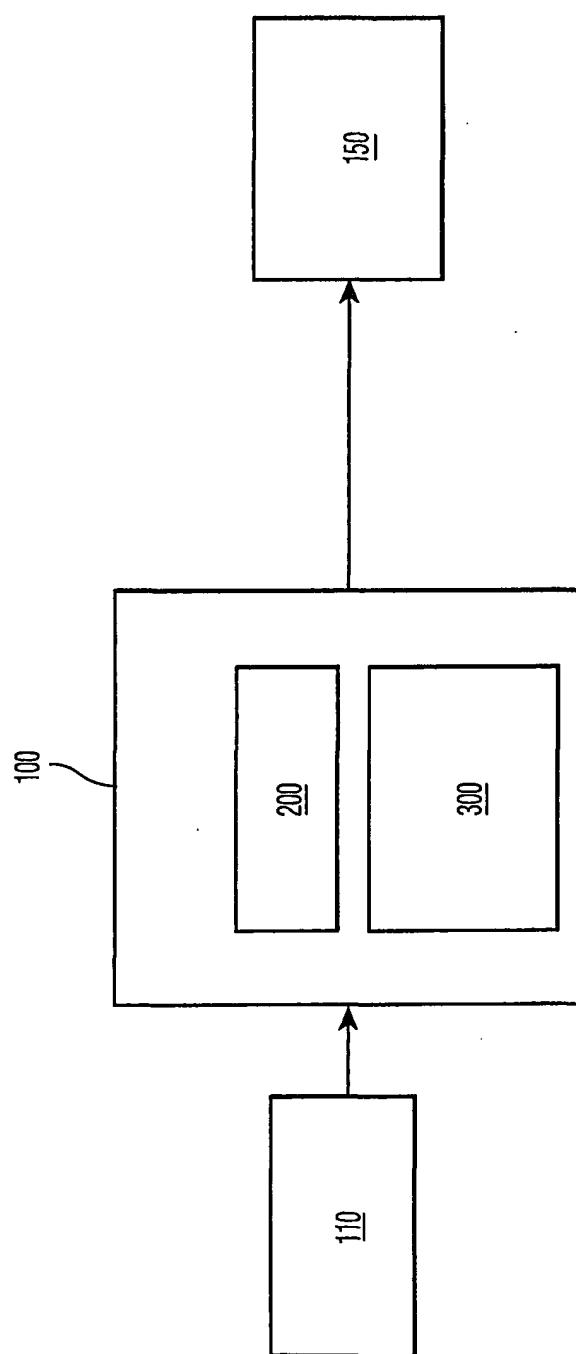


FIG. 1

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<u>240</u>	<u>245</u>	<u>250</u>	<u>255</u>	<u>...</u>	<u>270</u>
11/18/99 – 8:00 P.M.	CH 1	LUCY	COMEDY		55
11/18/99 – 8:30 P.M.	CH 1	AL'S FAMILY	SITCOM		78
<u>205</u>	<u>...</u>				
11/18/99 – 9:00 P.M.	CH 3	YOUR HOUSE	DRAMA		96
<u>210</u>					
<u>220</u>					

FIG. 2

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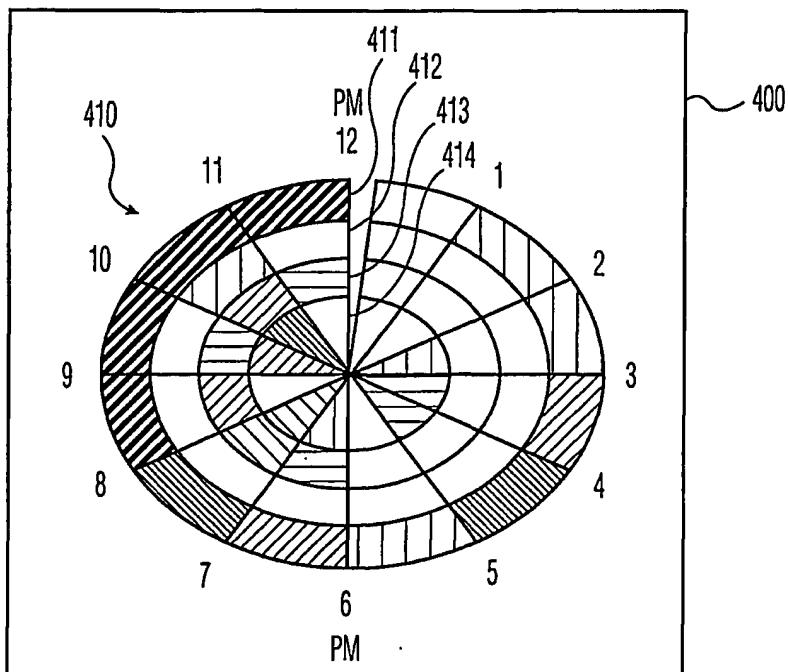


FIG. 3A

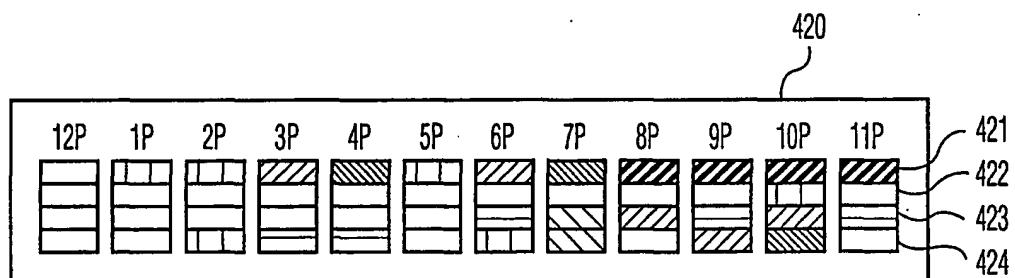


FIG. 3B